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..CALENDAR..

OF THE

SCHOOL OF MINING

(AFFILIATED WITH QUEEN'S UNIVERSITY)

KINGSTON, ONTARIO.

FIFTH SESSION,

1897-'98.

KINGSTON:
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1897.

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KINGSTON, ONTARIO

JOHN CARRUTHERS SCIENCE HALL. MINING LABORATORY.

SCHOOL OF MINING.

CALENDAR 1897-8.

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1897/98

VISITOR.

His Honour GEORGE A. KIRKPATRICK, D.C.L., LL.D., &c., Lieutenant-Governor of Ontario.

Chairman of the Board of Governors.....EDW. J. B. PENSE.
Vice-Chairman .....JOHN MCKELVEY.

BOARD OF GOVERNORS.

E. J. B. PENSE.....Kingston.
JOHN MCKELVEY.....Kingston.
E. W. RATHBUN.....Deseronto.
JAS. SWIFT.....Kingston.
G. M. MACDONNELL, Q.C.....Kingston.
HON. WM. HARTY, M.P.P.....Kingston.
JAS. S. HAYDON.....Camden East.
ROBERT CRAWFORD.....Kingston.
GEO. Y. CHOWN, B.A.....Kingston.
W. BRUCE CARRUTHERS.....Kingston.
A. BARNET .....Renfrew.
W. F. NICKLE, B.A..... .....Kingston.
C. LIVINGSTON.....
THOS. DONNELLY..... } Appointed by the City Council.
THE WARDEN OF THE COUNTY OF FRONTENAC.

GEO. Y. CHOWN, B.A.....Treasurer.
A. P. KNIGHT, M.A., M.D.....Secretary.

ADVISORY COMMITTEE.

The President of the Eastern Ontario Dairymen's Association.

W. R. WHITE, Q.C., Pembroke.
D. M. MACPHERSON, M.P.P., Lancaster.
JAS. STRATTON, M.P.P., Peterboro.
W. B. DALTON.
J. CARSON.
J. L. HAYCOCK, M.P.P.

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CALENDAR.

1897.

July	5—Summer School opens.
August	4—Summer School closes.
September	1—Notice of intention to appear at Matriculation or Supplementary Pass Examination to be given in writing to the Registrar of Queen's University. Subjects upon which a candidate intends to write must be stated in his notice.
"	16—Examinations begin. (Held at Queen's University and such other points as may be fixed upon.)
October	1—Classes open. (1st term.)
"	16—Holiday.
December	18—Christmas Holidays begin.

1898.

January	4—Classes re-open. (2nd term.)
"	4—Prospectors' Course begins.
February	23—Holiday.
March	4—Prospectors' Course ends.
April	8—Class work closes.
"	9—Examinations begin.
"	27—Convocation, for distributing prizes, announcing honours, and laureating graduates.

FACULTY.

WM. L. GOODWIN, B.Sc. (LOND.), D.Sc. (EDIN.), F.R.S.C.,
DIRECTOR and Professor of Chemistry.

WILLIAM NICOL, M.A.,
Professor of Mineralogy, Metallurgy and Assaying.

WILLET G. MILLER, B.A.,
Professor of Geology and Petrography.

.....
Professor of Mining Engineering.

R. CARR HARRIS, C.E.,
Professor of Engineering.

WILLIAM MASON,
Lecturer on Drawing and Surveying.

N. F. DUPUIS, M.A., F.R.S.C.,
Lecturer on Mechanism.

NORMAN F. CARMICHAEL, M.A.,
Lecturer on Electrical Engineering.

JOSEPH BAWDEN, Barrister-at-Law,
Lecturer on the Law of Mines.

.....
.....
DR. ISAAC WOOD, M.A.,
WM. MOFFAT, M.A.,
} Laboratory Demonstrators.

WILLIAM MASON, Bursar.
ALFRED DEAN, Janitor.

96-97

LIST OF STUDENTS.

REGULAR STUDENTS.

FIRST YEAR.

Name.	Address.	Branch of Engineering.
Anglin, Jas. P.	Kingston	Mechanical.
Jackson, Fras. W.	Kingston	Mechanical.
Lindsay, Hamilton	Kingston	Civil.
Mann, Wm. Edward	Kingston	Mining.
Newlands, Lawrence C.	Kingston	Mining.
Rothwell, Chas. Garnett	Kingston	Mining.
Smallwood, Harold	Toronto	Mining.
Smeeton, Wm. Fras.	Oakville	Mining.
Smith, Henry P.	Kingston	Civil.
Squire, Samuel H.	Kingston	Mechanical.

SECOND YEAR.

Cotton, Miles P.	Kingston	Electrical.
Graham, Stanley	Kingston	Civil.
Lavell, Walter H.	Toronto	Mining.
Merritt, Chas. P.	St. Catharines	Mining.

THIRD YEAR.

Fortescue, C. L.	Kingston	Electrical.
Spotswood, M. Geo.	Kingston	Mining.
Wells, Jas. Walter	Toronto	Mining.

FOURTH YEAR.

Donnelly, John, Jr.	Kingston	Mining.
Kirkpatrick, Guy	Toronto	Mining.
Mabee, Horace C.	Port Rowan	Mining.
Scott, Thos. Smythe	Glenmorris	Civil.

PROSPECTORS' CLASS.

Name.	Address.
Clark, Walter N	West Selkirk, Man.
Connor, Louis C	Galt, Ont.
Davis, Allan R	Napanee, Ont.
Dickson, Geo. H	Kingston, "
Edgar, David K	Toronto, "
Farncomb, Ernest A	London, "
Folger, Collamer C	Kingston, "
Grier, Percy L	Owen Sound, Ont.
Keenan, John Joseph	Kingston, "
Lees, William	Brockville, "
McLenhan, John A	Owen Sound, "
Mackay, J. Walnick, M.A., B.Sc., Edin	Toronto, "
Mackenzie, James	Fort Frances, "
Magee, Robert Boyd	Toronto, "
Magee, Wm. Knox	Toronto, "
Megraw, Ainsley	Wiarton, "
Perry, James Rudston	Napanee, "
Riordan, Chas. C	St. Catharines, "
Rogers, James Wilbert	Toronto, "
Russell, Corsan L	Pembroke, "
Saunders, Bryce J	Brockville, "
Scott, Oswald N	Listowel, "
Sutton, Ford	Madoc, "
White, Chas. T	Pembroke, "
Whitfield, Thos. G	Whitby, "
Williams, David	Kingston, "
Wylie, Wm. Hamilton	Niagara, "
Zealand, Thos. Forrest	St. Catherines, "

EXTRAMURAL PROSPECTORS' CLASSES.

Places.	Nos. of Students.
Eganville	25
McDonald's Corners	25
Mine Centre	43
Port Arthur	71
Rat Portage	46
Renfrew	50
Sault Ste. Marie	48
Total	308

Students in University Faculties other than Engineering, 122.

ANNOUNCEMENT.

The SCHOOL OF MINING is a branch of the *School of Mining and Agriculture*, incorporated by Act of the Legislature of Ontario.

OBJECTS.—The objects of the School of Mining are to give a thorough scientific education, both theoretical and practical, to men studying for the professions of the mining engineer, the assayer, the consulting geologist, and the metallurgist; and to provide for prospectors, mine foremen and others interested in the discovery and winning of minerals such instruction as shall make their occupations more interesting and less liable to failure.

SITUATION.—The School has been placed near Queen's University so as to take advantage of the instruction therein provided in English, mathematics, physics, and the biological sciences. It is in this way possible to equip and carry on a good technical school on a much smaller revenue than would otherwise be called for to maintain the high standard of scholarship which the age demands of the engineering profession.

Kingston is peculiarly well situated as the seat of a Mining School. Geology and mineralogy, two of the fundamental subjects of a mining engineer's education, are studied to best advantage where the minerals can be seen as they lie in nature, and where geological formations can be examined *in situ*. In a few hours a class of students can be taken by carriage from our school to a region so rich in mineral species that about forty different kinds have been secured in an afternoon. There is also a great variety of geological formation right at our doors. If to this be added the neighborhood of mines in process of development or in operation, the result is an ideal Mining School city. The German Government has planted its mining schools in just such cities, where the education of the mining engineer can be given that practical turn which not only lends a charm to the period of his study, but shortens the time between graduation and thorough efficiency and confidence in the practice of his profession.

The possibilities of the country to the north of us are, in these respects, very great, and a glance at a geological map shows that Kingston itself is situated where the mineral-bearing formations, cutting like a broad wedge through the limestone, reach the St. Lawrence and Lake Ontario. The region of mineral-bearing rocks is thus brought almost to the gates of the city. On either side of us the water front is bordered by a band of limestone, broadening as it extends east and west.

EMPLOYMENT FOR GRADUATES.—While we do not promise to secure employment for graduates of the School, those who show themselves capable and industrious will be recommended to positions for which they are qualified. It must be distinctly understood, however, that recommendations will not be given to men merely because they have been students at this School. Employers of mining engineers and assayers are requested to note that men who have studied here can produce certificates stating clearly their standing in the School; and that no one is entitled to style himself a graduate of the School unless he has completed either a three years' or a four years' course.

EXPENSES OF A COURSE.—The following statement of expenses is made from information obtained from students who have kept account of their expenditures. The expense for class fees increases by five dollars a year, but the average is taken in this estimate.

FOR EACH SESSION.

Board, lodging and washing	$ 98 00 to	$115 00
Books and stationery	10 00 "	12 50
Incidentals	8 00 "	15 00
Excursions (geology, mineralogy and mining)	4 00 "	6 00
Class and other fees	52 50	52 50
	$172 50	$201 00

These estimates are based on board, &c., at from $3.00 to $3.75 a week, at which rates good board can be had in Kingston.

The fee for graduation ($20.00) is not included in the estimated.

REQUIREMENTS FOR ADMISSION.

The School of Mining is open to all who wish by earnest study to enlarge their knowledge of minerals and mines, or to pursue science for its own sake. The atmosphere of the School is suitable only for those who are fond of steady work.

REGISTRATION.—All students are required to register and pay the registration fee at the beginning of each session. In addition, those who are pursuing degree or diploma courses are required to register in Queen's University and to pay a registration fee of one dollar.

MATRICULATION.—Before being admitted to examination on the work of the course, candidates for a degree must pass the matriculation examination, or otherwise satisfy the Faculty of their fitness to proceed with their course. Matriculation consists

of the Junior Leaving examination for Ontario in the subjects of English and Mathematics. The details of this examination may be found in the Calendars of Ontario Universities, or in the Regulations of the Education Department. The matriculation examination may also be taken in Queen's University in September, (English, Sept. 20th and 25th; Mathematics, Sept. 22nd and 23rd.) Other examinations will be accepted so far as they are equivalent. Candidates who have made at least fifty per cent. on the papers in any of the Senior Leaving examination subjects are not required to take the junior classes in those subjects.

While students are admitted upon matriculating in English and Mathematics, it is strongly urged upon them to take the complete matriculation examination with the modern language and science option. (See p. 11, Calendar of Queen's University.) As a good grounding in Mathematics is necessary, it will be found advantageous to have attained the Senior Leaving standard in that subject before entering.

Students who have already taken, in a University Arts or Science Faculty or in a recognized technical or military school, subjects included in a degree course in the School of Mining, will be admitted to the year for which they are qualified, on entering upon a course for the degree of M.E. or B.Sc.

The B.Sc. course in chemistry and mineralogy can be completed in one year after graduation in an honour course in arts, in chemistry, mineralogy and geology.

Special Students.—Unmatriculated students may take any classes for which they are prepared. The work in Chemistry, Mineralogy, Geology, Drawing, Surveying, etc., is so arranged that those who wish to study these subjects, either for their scientific interest or as leading to professions other than mining engineering, may profitably pursue their studies here.

The practical work in assaying, mineralogy, milling, and mining is of such a nature that those who wish to prepare themselves for any special department of work connected with mining and milling may profitably spend a session or two at the school. A two years' course might include junior chemistry, blowpipe analysis, qualitative analysis, systematic mineralogy, and geology, the first year; and chemistry of metals, assaying, descriptive and determinative mineralogy, mining, milling, ore dressing, and ore deposits, the second year.

Special short courses for prospectors and others are conducted during the session. (See p. 36.)

EXTRAMURAL STUDENTS.—Students who are not able to attend the school may register in the classes of junior and senior chemistry, elementary mineralogy, and geology. Tutors are appointed to assist them by correspondence.

FEES.—Registration and Class fees must be paid annually on or before October 16, and Laboratory fees before students begin work in the laboratories.

Registration	$ 1 00
University Registration	1 00

FEES FOR A COURSE IN *Mining Engineering, in Analytical Chemistry and Assaying, or in Mineralogy and Geology.*—

These fees cover all class and laboratory fees for the course.

First Year	$40 00
Second Year	45 00
Third Year	50 00
Fourth Year	55 00

FEES FOR SINGLE CLASSES, &C.

Junior and Senior Chemistry each	$12 00
Any other Course of Lectures	8 00
Drawing	9 00
Surveying, per Session	5 00
Assaying Laboratory for Session	5 00
Chemical Laboratory for Session	20 00
Petrographical Laboratory for Session	5 00
Analytical Chemistry (Medical)	12 00
Graduation Fee	20 00
Annual Examination Fee	3 00
Tutor's Fee (Extramural Students), one subject	5 00
" " " more than one subject	10 00

COURSES OF STUDY.

The following courses are offered:

I. Three years' courses for a diploma in

(A.) Mining Engineering.
(B.) Analytical Chemistry and Assaying.

II. Four years' courses for the Degree of Bachelor of Science (B.Sc.) in

(A.) Mining Engineering.
(B.) Chemistry and Mineralogy.
(C.) Mineralogy and Geology.

The degree of Mining Engineer (M.E.) is also conferred. (See p. 14.)

III. Post-graduate courses for the degree of Doctor of Science (D.Sc.) (For further information see the calendar of Queen's University.)

I.—THREE YEARS' COURSES.

These courses are intended to fit men to enter upon the practice of mining engineering and assaying. The scientific groundwork of these professions is included as completely as the length of the course will permit; and much time is given to those practical studies which best equip the student for the work of exploration, developing, supervision, construction, etc., connected with mining. The courses are so arranged that upon completing them students may, if they wish, by another year's study, complete the course for a degree.

The arrangement into years is not compulsory, but students are advised to follow it as closely as circumstances will permit.

A.—MINING ENGINEERING.

FIRST YEAR.

First Term.	*Second Term.*
Algebra and Geometry,	Algebra and Geometry,
Junior English,	Descriptive Astronomy,
Junior Physics,	Junior English,
Junior Chemistry,	Junior Physics,
Drawing,	Junior Chemistry,
Blowpipe Analysis,	Drawing,
Surveying,	Blowpipe Analysis,
Workshop.	Qualitative Analysis,
	Workshop.

SECOND YEAR.

First Term.	*Second Term.*
*Higher Algebra,	*Higher Algebra,
Solid Geometry,	Solid Geometry,
Senior Physics,	Plane Trigonometry,
Senior Chemistry,	Senior Physics,
Elementary Crystallography,	Senior Chemistry,
Qual. Analysis of Minerals,	Quantitative Analysis,
Systematic Mineralogy,	Systematic Mineralogy,
Geology.	Geology,
Drawing and Designing,	Drawing and Designing,
Workshop,	Workshop.
Surveying.	

THIRD YEAR.

First Term.	*Second Term.*
*Co-ordinate Geometry,	*Co-ordinate Geometry,
*Elementary Differential and Integral Calculus,	*Elementary Differential and Integral Calculus,
Spherical Trigonometry,	Practical Astronomy,
Descriptive Mineralogy,	Technical Chemistry,
Determinative Mineralogy,	Descriptive Mineralogy,
Geology and Petrography,	Determinative Mineralogy,
Assaying,	Geology and Petrography,
Mining,	Assaying,
Ore Dressing,	Economic Geology,
Surveying,	Mining,
Engineering,	Engineering,
Elementary Electrical Engineering.	Ore Dressing,
	Milling.

B.—ANALYTICAL CHEMISTRY AND ASSAYING.

FIRST YEAR.

First Term.	*Second Term.*
Algebra and Geometry,	Algebra and Geometry,
Junior English,	Junior English,
Junior Physics,	Junior Physics,
Junior Chemistry,	Junior Chemistry,
Drawing,	Qualitative Analysis,
Blowpipe Analysis,	Drawing,
Surveying.	Blowpipe Analysis.

SECOND YEAR.

First Term.	*Second Term.*
Solid Geometry,	Adv. Algebra and Pl. Trig.
Adv. Algebra and Pl. Trig.	Senior Chemistry,
Senior Chemistry,	Qualitative Analysis,
Elementary Crystallography,	Systematic Mineralogy.
Qualitative Analysis,	
Systematic Mineralogy.	

THIRD YEAR.

First Term.	*Second Term.*
Organic Chemistry,	General Chemistry,
Crystallography,	Technical Chemistry,
Descrip. and Det. Mineralogy,	Descrip. and Det. Mineralogy,
Geology and Petrography,	Geology and Petrography,
Quantitative Analysis,	Quantitative Analysis,
Assaying,	Assaying,
Metallurgy.	Metallurgy,
	Ore Deposits.

II.—FOUR YEARS' COURSES.

These courses are arranged so as to give the extended scientific training required for the more highly specialized fields of professional work in mining, assaying, analytical chemistry, mineralogy and geology. Courses A and B may be completed in one year after completing the corresponding three years' course. Course C affords a general education in natural science with special training in mineralogical and geological work and studies. It is intended for those who have in view the profession of consulting geologist or the work of geological surveys.

A.—MINING ENGINEERING.

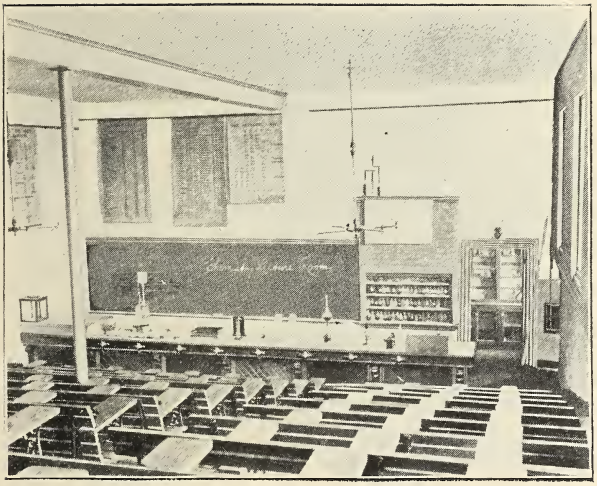
The first three years of this course are the same as for the Three Years' Course. (See page 12.)

FOURTH YEAR.

First Term.	*Second Term.*
Metallurgy,	Metallurgy,
Mechanism,	Mechanism,
Engineering,	Engineering,
Mining Engineering,	Mining Engineering,
Milling,	Milling,
Mining Law.	Mining Law.

The combined degrees of Bachelor of Science (B.Sc.) and Mining Engineering (M.E.) are awarded on the completion of this course, and the production of certificates for not less than three months' work in a mine or in mines. These certificates must be signed by mine managers, and must state the character of the work done by the candidate. Candidates may omit the subjects marked * and the certificates for practical mining, and graduate with the degree of Bachelor of Science only.

Certificates of proficiency in applied mathematics and mechanics may be accepted *pro tanto* for the mathematics of this course.



CHEMISTRY LECTURE ROOM.

B.—CHEMISTRY AND MINERALOGY.

The first three years of this course are the same as for the Three Years' Course. (See p. 13.)

FOURTH YEAR.

I. Special work in assaying and chemical analysis to give facility and precision in methods in use in mining, furnace, and analytical laboratories.

II.—An original research in Chemistry or Mineralogy.

C.—MINERALOGY AND GEOLOGY.

FIRST YEAR.

First Term.	*Second Term.*
Algebra and Geometry,	Algebra and Geometry,
Junior English,	Junior English,
Junior Physics,	Descriptive Astronomy,
Junior Chemistry,	Junior Physics,
Drawing,	Junior Chemistry,
Blowpipe Analysis,	Drawing,
Animal Biology.	Blowpipe Analysis,
	Botany.

SECOND YEAR.

First Term.	*Second Term.*
Solid Geometry,	Senior Chemistry,
Plane Trigonometry,	Plane Trigonometry,
Senior Chemistry,	Qualitative Analysis,
Elementary Crystallography,	Systematic Mineralogy,
Qualitative Analysis,	Geology.
Systematic Mineralogy,	
Geology,	
Surveying.	

THIRD YEAR.

First Term.	*Second Term.*
Crystallography,	Spherical Trigonometry,
Assaying,	Assaying,
Descrip. and Det. Mineralogy,	Simple Quantitative Analysis,
Geology and Petrography,	Descrip. and Det. Mineralogy,
Topographical Surveying,	Geology and Petrography,
Field Geology.	Geological Maps and Sections.

FOURTH YEAR.

First Term.	*Second Term.*
Petrography,	Petrography,
Economic Geology.	Economic Geology.

Special work along lines to be chosen by the candidate; an original research in Mineralogy or Geology.

SUBJECTS OF STUDY.

CHEMISTRY.

Professor: William L. Goodwin, D.Sc., Edin.

Demonstrators: Wm. Moffat, M.A., and I. Wood, M.A., M.D.

JUNIOR.

1. *Lectures* on the principles of Chemistry as follows:
Chemical Species—Crystals and Crystallisation—Chemical Change—Laws of Combination—Relation of Heat to Chemical Changes—Notation—Equations—Nomenclature—Volume Relations of Gases in Chemical Change—Volume Formulas—The Atomic Theory—Descriptive Chemistry of the Common Elements and their Compounds—Electrolysis—Spectrum Analysis.

Books—Goodwin's Chemistry (Uglow & Co., Kingston).
Remsen's Inorganic Chemistry (Advanced Course).

Mondays and Tuesdays at 11 a.m.

2. *Laboratory practice*, consisting of simple experiments, by means of which the student may become acquainted with the properties of common substances. Wednesdays or Thursdays at 11 a.m.

3. *Qualitative Analysis* is begun in the second term.

SENIOR.

(**1st TERM**). 1. *Lectures* on the chemistry of the metals, their occurrence in nature, reduction and uses. Thursdays and Fridays at 11 a.m.

2. A course of ten lectures on *Elementary Crystallography*. Mondays, Tuesdays, Wednesdays, Thursdays and Fridays at 8 p.m.

3. *Qualitative Analysis* is continued. Notes on systematic qualitative analysis are given in a course of fifteen lectures by Professor Nicol in October.

(**2nd TERM**). 1. *Lectures* on chemical laws and theories. Thursdays at 11 a.m.

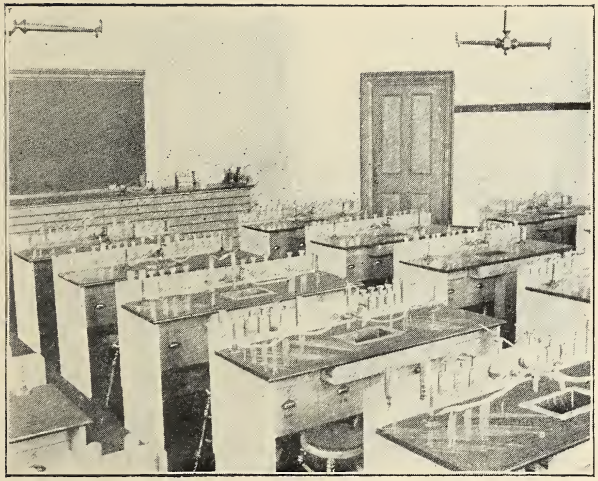
2. *Qualitative Analysis of Minerals and Simple Quantitative Analysis.* This work may occupy from two to four hours a day. The greater part of the time is spent in the laboratories. *Lectures* on quantitative analysis on Thursdays at 3 p.m. The minimum amount of work in quantitative analysis is comprised in Bolton's *Quantitative Analysis*, Nos. 1, 2, 3, 5, 6, 7, 8 and 13.

Books—Dobbin & Walker's Chemical Theory (Macmillan & Co.)
Goodwin's Chemistry and Supplement (Uglow & Co.)
Ritcher's Inorganic Chemistry (P. Blakiston, Son & Co.)
Williams' Crystallography (Henry Holt & Co.)
Thorpe & Muir's Qualitative Analysis (Longmans, Green & Co.)
Bolton's Quantitative Analysis.

THIRD YEAR.

(**1st TERM**). 1. *Lectures and Class Work on Organic Chemistry*. The student is expected to master the contents of Remsen's Organic Chemistry.

Wednesdays at 3 p.m.



LABORATORY NO. 3.

2. *Advanced Crystallography* studied in its relations to chemistry and mineralogy. The student has access to collections of wooden and wire models and mounted crystals.

Mondays, Tuesdays and Thursdays at 3 p.m.

3. *Quantitative Analysis* is continued throughout the third year by students taking the courses in Chemistry and Assaying, or Chemistry and Mineralogy. Special attention is given to the quantitative analysis of minerals.

Text-book—Fresenius' Quantitative Analysis.

(**2nd TERM**). 1. *Lectures* on selected subjects in *Technical Chemistry*. For the session of 1897-1898 the subjects will be Fuels, Ores, Fluxes and the chemistry of gold, silver, copper, and nickel reduction.

Mondays at 3 p.m.

2. *Lectures on General Chemistry*. For the session of 1897-1898 the subjects will be Thermochemistry, Electrochemistry, and Kinetic Theory of Gases.

Text-book—Ostwald's Outlines of General Chemistry.

Wednesdays at 3 p.m.

3. *Quantitative Analysis.*

FOURTH YEAR.

The work for the fourth year consists entirely of laboratory work in quantitative analysis. Students taking the M.E. course may extend their acquaintance with analysis of minerals, slags, etc. Those taking the B.Sc. course in chemistry and mineralogy will, in addition, carry on experimental work in some selected field, such as rock analysis, organic analysis, analysis of water, air, foods, fertilizers, soils, etc.

All students are urged to make daily use of the library, reading along the lines of their laboratory work.

THE CHEMICAL LABORATORIES.

The practical work in Chemistry is carried on in three laboratories: No. 1 for qualitative analysis, No. 2 for quantitative analysis, and No. 3 for experimentation in class, and drill on the subjects treated of in the junior lectures. No. 1 and No. 2 are fitted up with 62 and 42, respectively, locked work places, so that 104 students can be provided each with a set of apparatus under lock and key. These laboratories are open from 8 a.m. to 5 p.m., and students are allowed to carry on their analytical work when not otherwise engaged. The number of hours a day to be spent in the laboratories depends, to some extent, on the aptitude of the student for experimentation. The average is about two and a half hours. No. 3 serves both as a laboratory aud a class room. It is fitted up with seats and desks which are at the same time work tables. Besides these larger laboratories there are smaller rooms devoted to special branches of analytical chemistry and to research.

Each student, before entering the junior practical class, is required to deposit two dollars with the Bursar, and before entering any other practical class, five dollars. On presenting to the instructor of the class the receipt for this and the class ticket, the student receives the key of his place and a set of apparatus. The deposit is returned at the end of the session, breakages, etc., having been deducted.

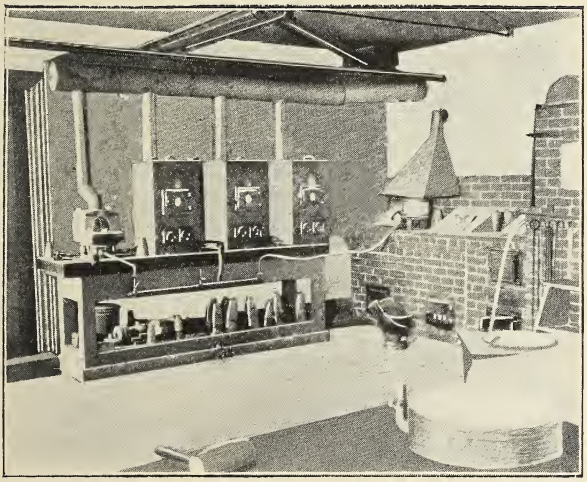
ASSAYING.

Professor: William Nicol, M.A.

The work of the Assaying Class is carried on partly in the assaying laboratory and partly in the quantitative chemical laboratory, as assaying is a branch of quantitative analysis. The assay laboratory is equipped for conducting fire assays of the metallic ores. As assaying forms an important part of milling, the crusher and sample grinder of the mining laboratory are employed for preparing larger samples for assay. Smaller samples are prepared by hand, using mortars, the "buck-board," sieves, etc. A balance room adjoins the assay laboratory and is supplied with pulp balances for weighing in the ore. The assay laboratory is furnished with one large muffle furnace for soft coal, four portable coke furnaces (Brown pattern), one portable charcoal furnace, a set of portable gasoline furnaces, one gas muffle furnace, one gas crucible furnace, one combined muffle and crucible gas blast furnace, and three wind crucible furnaces for hard coal. The object is to prepare students for working with the different kinds of fuel. The laboratory is well supplied with ore-bins and samples of pulverized ore, so that practice may be had with a variety of ores. The work begins with an assay of coal to ascertain its commercial value. A thorough course in the analysis of iron ores by wet methods is given. The work is carried on, as far as possible, on the plan of Professor Ledebur, of Freiberg. Blair's "Analysis of Iron" is used as a text-book, supplemented by lectures delivered early in the session. The assays of copper, nickel, lead and zinc are made partly by the dry method, partly by electrolysis, and partly by titration.

Text-books—Chapman's Assay Notes, (Copp-Clark Co.)
Brown's Manual of Assaying, 5th ed. (Sargent & Co., Chicago.
Blair's Chemical Analysis of Iron, 2nd ed. (Lippincott Co.)
Lord's Notes on Metallurgical Analysis.
Ricketts & Miller's Notes on Assaying (Wiley & Sons.)

Books for reference:
Beringer's Text-book of Assaying (C. Griffin & Co.)
Bodemann & Kerl's Assaying.
Furman's Manual of Assaying (Wiley & Sons.)



FURNACES:—ASSAY LABORATORY.

MINERALOGY.

Professor: William Nicol, M.A.

The course in Mineralogy extends over three years. The work of the first-year class is intended as a preparation for those entering upon the studies of geology, petrography, and metallurgy. The class should be taken along with the classes of junior chemistry and junior physics, as a knowledge of chemistry and physics is necessary for a proper comprehension of the subject. The work consists of lectures on the physical, optical, and other properties of minerals, the description of forty or fifty prominent Canadian minerals, followed by practical work in the determination of these. The lectures are illustrated by specimens from the lecture-cabinet, which is furnished with collections, to illustrate the physical, optical, and other properties of minerals. The practical work of the class is conducted in the mineralogical and blowpipe laboratory, where cabinets containing specimens of commonly occurring minerals are provided. The students are taught to recognize minerals by simple field tests, such as color, form, hardness, specific gravity, etc. For this work students must provide themselves with a knife, a magnet, a pocket lens, and a streak plate.

The practical work in mineralogy is supplemented by practical instruction in the use of the blowpipe, which is of so much importance in studying the chemical properties of minerals, and also as an aid to qualitative analysis. The blowpipe laboratory is furnished with the necessary apparatus for twenty-four students.

The work of the second year class is an extension of that of the first year, and is intended to prepare students for undertaking descriptive and determinative mineralogy in the third year, and as an aid in the study of petrography. More attention is given in this class to the study of the physical, optical, thermal, electrical, and other properties of minerals. Specimens, models, thin sections, charts, and lantern slides are used to illustrate the lectures. For determining the specific gravity of minerals, a specific gravity balance, a Jolly's spiral balance, and a Nicholson's areometer, are provided for use by students.

The work of this class—systematic mineralogy—is supplemented by a practical class in crystallography (for details see under *Chemistry*), and by practical and theoretical work in the qualitative analysis of minerals in the qualitative laboratory.

The work of the third year class consists of descriptive mineralogy, determinative mineralogy, the quantitative analysis of minerals, petrography and ore deposits. For the descriptive

part the museum collection of minerals of the school is used. Dana's *System of Mineralogy* is used as a text-book in the class. The descriptions are read, and comparisons are made with the specimens. The mineral specimens are constantly being increased by collection, donation and purchase, the aim being to make the museum as complete and representative as possible. Special attention is given to Canadian ores and gangue minerals, as this class aids very materially in the study of ore deposits. No attempt is made to get the minerals "by rote," the desire being rather to acquire a practical working knowledge of them, such as would be useful to the assayer, consulting geologist, or mining engineer.

The work in connection with determinative mineralogy is taken in two parts : (*a*) practical mineralogy and (*b*) determination by the blowpipe. For the first part (*a*), cabinets filled with specimens of minerals are provided for use. Students are permitted to handle the specimens and test them by ordinary field tests, such as form, color, hardness, etc. The object of this class is to enable students to recognize minerals in the field. Fraser's *Tables for the Determination of Minerals* is used as a guide. For the second part (*b*), practical instruction is given in the blowpipe laboratory in the determination of minerals. The object of the class is to assist students in acquiring a knowledge of the chemical properties of minerals, and to enable them to test minerals in the field, or more leisurely at home. The advantage that this class affords to the prospector and field geologist is at once apparent.

Each student is supplied with certain pieces of blowpipe apparatus, for the care of which he is held responsible. As far as possible the work of this class is carried on parallel with that in descriptive mineralogy, as the blowpipe characters form an important part in the description of every mineral.

For details of the work in quantitative analysis of minerals, see under *Chemistry*; and for details of the work in petrography and ore deposits, see under *Geology*.

First Year.

Blowpipe Analysis—(*a*) A course of practical demonstrations to illustrate and explain reactions in studying the chemical properties of minerals, (one hour per week). (*b*) A practical class in which the experiments seen in the lectures are performed by the students (one hour per week).

Text-books—Chapman's Blowpipe Practice, 2nd ed. (Copp-Clark Co.)
Dana's Minerals and How to Study Them.

Books for reference:

Cornwall's Translation of Plattner's Manual of Qualitative and Quantitative Analysis with the Blowpipe. 7th ed. (Van Nostrand Co.)

Endlich's Manual of Qualitative Blowpipe Analysis.

Moses & Parson's Mineralogy, Crystallography and Blowpipe Analysis.

Brush and Penfield's Manual of Determinative Mineralogy and Blowpipe Analysis. (Wiley & Sons.)

Landauer's Blowpipe Analysis.

Students must supply their own blowpipe apparatus.

Second Year.

1. Systematic Mineralogy.

Text-book—Bauerman's Systematic Mineralogy. (Longmans, Green & Co.)

Books for reference:

Naumann-Zirkel's *Mineralogie.*

Tschermak's *Mineralogie.*

Dana's Text-book of Mineralogy, 15th ed. 1889. (John Wiley & Sons.)

2. Crystallography.

Lectures and practical study of crystal forms by means of natural crystals, and wooden and wire models.

Williams' Crystallography. (Henry Holt & Co.)

3. Qualitative Analysis of minerals by blowpipe and wet reagents.

Lectures on Qualitative Analysis.

Text-book—Fresenius' Qualitative Analysis.

4. Essays on prescribed subjects.

Third Year.

1. Descriptive Mineralogy.

Tuesday and Friday at 9 A.M.

Description and classification of the commonly occurring minerals, special attention being given to Canadian Ores. Examination of specimens from cabinets.

Text-book—Dana's System of Mineralogy, 6th ed. (Wiley & Sons.)

Books for reference:

Chester's and English's Catalogues of Minerals.

Chapman's Minerals and Geology of Ontario and Quebec. 3rd ed. (Copp-Clark Co.)

Commissioners' Report on Mineral resources of Ontario, 1890.

Reports of Bureau of Mines, 1891-7.

2. Determinative Mineralogy.

Practical instruction in the determination of minerals by means of the blowpipe and by field tests.

Text-books—Crosby's Tables for the Determination of Common Minerals.

Frazer's Tables for the Determination of Minerals, 3rd ed., 1891. (J. B. Lippincott & Co., Phila.)

Brush and Penfield's Manual of Determinative Mineralogy and Blowpipe Analysis, 13th ed. (Wiley & Sons.)

3. Quantitative Analysis of Minerals (selected samples).

Text-book—Fresenius' Quantitative Analysis.

4. Lectures on Quantitative Analysis.

GEOLOGY AND PETROGRAPHY.

Professor: Willet G. Miller, B.A.

The instruction in this department is adapted to the needs of the prospector, the mining engineer, and the professional geologist. Provision is also made for persons who desire a knowledge of the subject as part of a general education. Graduates and others who wish to pursue some special line of investigation, or to have the use of the laboratories and apparatus, in order to work up material collected by themselves, will have every facility placed at their disposal.

Students have access to the museum of Queen's University, which contains a large number of specimens illustrative of the geology of Canada, as well as to the collections of the school.

A course in field geology, lasting about three weeks, is given, during September in each year. Particulars concerning the course may be obtained from the Bursar.

Second Year.

GEOLOGY.

The object of this course is to give a general knowledge of the subject as an introduction to the work of the third and fourth years.

The following themes will be treated of in the lectures :— The planetary relations of the earth; the atmosphere; waters; solid crust; probable nature of the earth's interior; rocks, their general megascopic and microscopic characters and classification; volcanic action; earthquakes; upheaval; subsidence; geological effects produced by heat, air, water, and life; bosses; dykes; veins; stratification; dip; strike; anticline and syncline; faults; foliation; nature and uses of fossils; stratigraphical geology; outline of the geological history of the globe, etc.

The lectures are illustrated by means of maps, diagrams, and lantern views.

The laboratory work will consist of the examination of typical specimens of the different groups of fossil plants and animals, and of hand specimens of the more common rocks.

During the months of October and November excursions will be made to places of geological interest in the vicinity of Kingston.

Text-books and books for reference:

Le Conte's Compend of Geology.
Dana's Manual of Geology (last edition).
Chapman's Minerals and Geology of Ontario and Quebec.

Third Year.

GEOLOGY.

In this course special attention will be given to stratigraphical geology and the geology of Canada. Type fossils of the different formations will be studied.

Text-books and books for reference :

Chapman's Minerals and Geology of Ontario and Quebec.
Dawson's Geology of Canada.
Dana's Manual of Geology.
Wood's Elementary Palæontology.
Geological Survey Reports of Canada.

PETROGRAPHY.

This course will consist of lectures on the use of the petrographical microscope and accessories in the determination of the rock-forming minerals, together with the determination of some of the more common igneous rocks.

The lectures will be illustrated by means of microscopic projections of thin sections of minerals and rocks, and will be supplemented by a large amount of laboratory work.

A considerable variety of dyke rocks occurs in the Kingston district. These will be studied in the field, and specimens will be collected by each student for examination in the laboratory.

Boxes for holding slides, and material used in the preparation of thin sections may be obtained from the Bursar.

Text-books and books for reference :

Rosenbusch-Iddings' Microscopical Physiography of Rock-Forming Minerals.
Lœwinson-Lessing's Tables for the Determination of the Rock-Forming Minerals.
Hatch's Petrology.
Harker's Petrology for Students.

ORE DEPOSITS.

Lectures on the origin, modes of occurrence and uses of metalliferous minerals, with mention of the chief localities. The characters by which ore bodies are sometimes indicated to the prospector will be described. A sketch will be given of the geology of some of the leading mining districts.

Text-books and books for reference :

Phillips' Ore deposits.
Kemp's Ore Deposits of the United States.
Mineral Statistics, Geological Surveys of Canada and the United States.
Rothwell, The Mineral Industry. Vols. I, II, III and IV.

Fourth Year.

GEOLOGY.

A study will be made of structural and dynamical geology in connection with their bearings on economic problems.

Opportunities will be offered for those wishing to prosecute any special line of investigation.

Students are advised to devote as much time as possible to field work during the preceding long vacation, and to collect material for study in the laboratory during the winter.

Text-books—Geikie's Text-Book of Geology.
Dana's Manual of Geology.

PETROGRAPHY.

A course of lectures will be given on the microscopic characters and classification of the igneous rocks, and on the characters, origin and classification of the pre-Cambrian formations.

Special attention will be paid to the metamorphic series of the Kingston district, as exceptional opportunities are here offered for the study of the field relations of these rocks, and for attacking those problems as to their origin, which are now attracting the attention of geologists.

The *petrographical laboratory* is supplied with electric power and provided with diamond saws and other apparatus needed in the preparation of thin sections of minerals and rocks for examination with the microscope.

Laboratory facilities are also provided for micro-chemical tests, and for the use of heavy solutions in separating the constituents of rocks.

The school owns several petrographical microscopes of the latest and most improved designs.

Text-books and books for reference :

Rosenbusch—*Die Massige Gesteine.*
Zirkel—*Lehrbuch der Petrographie.* Vols. I, II and III.
Levy and Lacroix—*Les Mineraux des Roches.*
Rosenbusch-Iddings—Microscopical Physiography of Rock-Forming Minerals.
Iddings—The Origin of Igneous Rocks.
Van Hise—Correlation Papers, Archæan and Algonkian.

ECONOMIC GEOLOGY.

Lectures on the origin, modes of occurrence and uses of the metals and their ores ; materials used in the production of light and heat ; minerals used in chemical manufactures ; fertilizers ; mineral pigments ; salt, brine and mineral waters ; building materials ; cements ; refractory materials ; abrasive materials ; gems and precious stones ; miscellaneous.

MINING ENGINEERING AND ORE DRESSING.

Professor :

This course is given by lectures and text-book work, supplemented by models, drawings, photographs, the actual examination of mines, and practical work in milling, ore dressing, and sampling in the mining laboratory.

The lectures on the art of mining are designed to make the student familiar with the operations in vogue in this and other countries for finding, developing, extracting and mechanically treating minerals of economic value. It brings to a practical issue the information acquired by the lectures on mathematics, mechanics, surveying, and physics. A knowledge of chemistry and mineralogy is also necessary to give a satisfactory appreciation of the character of the ores searched for or extracted.

Connected with the mining of the ore, its geological association is considered.

This subject is covered by four courses.

The *first course* begins with the application of economic geology to the needs of the explorer or engineer, so that on the one hand he can intelligently search for, then develop a mineral deposit of economic value, and on the other hand he can study and value mining properties, locate appropriately the necessary plant and calculate the cost of production. It includes the discussion of faults and the means of finding faulted bodies, with practical problems. The subjects of blasting, timbering, and winning deposits are applied to actual cases, as driving a drift, etc., and problems from practical data are solved by the students.

The *second course* covers the subjects of underground and surface haulage, winding, loading, unloading and stocking ores, drainage or pumping, ventilation, lighting, descent and ascent, principles of employment, hygiene and mining laws and accidents. Problems are given in each of these subjects to cover cases that meet the enquirer in ordinary practice.

The *third course* treats of the mechanical preparation of ores by the wet, dry, or magnetic methods.

The *fourth course* deals with the milling of gold and silver ores, and the sampling of ores considered especially in connection with practical work in the mining laboratory, where it is intended also to illustrate roasting, chlorination and smelting processes.

It is expected that students will familiarize themselves with mining operations during the vacation, and arrangements will also be made for summer classes in mining regions.

The course includes the following heads, illustrated in each case by examples of the most advanced methods wherever they may be carried on, but especial mention is made of typical work which is being carried on in Canada.

Occurrence or manner in which the useful minerals are formed in the earth's crust. Classification of mineral deposits. Beds, strata, or seams; mineral veins or lodes; masses and their formation. Examples of the various modes of occurrence of the most important useful minerals. Irregularities in beds and veins, faults or dislocations, and rules for searching for the lost portion of a deposit. Examination and survey of mineral properties, relation of topography to geological structure, construction of maps and sections, and tracing of probable outcrops as a guide to exploration.

Prospecting or search for mineral deposits. Discoveries by chance or by mistake. Aid afforded by geology. Surface indications by form or colour of the ground or scattered fragments of the deposit. Decomposed outcrops of beds or veins. Association of minerals. Magnetic surveys with dip compass. Simple field tests of common ores. Prospectors' kit. Qualification of the prospector. Prospecting by pits, trenching, costeaning or husking. Importance of thorough surface prospecting work illustrated by examples.

Boring. Use of bore holes. Methods of boring. Percussion boring. With rods, Canadian method; with rope, United States method. Free falling tools. Rotary boring. Earth augers. Diamond drills worked by hand or by machinery. Hydraulic boring.

Mine Development. Choice of methods, location of openings; opening of shafts, slopes, tunnels, or drifts; sinking of winzing, and driving of crosscuts, drifts and adits.

Excavation. Hand tools, machine tools, steam diggers and dredges, hydraulic, endless chain, scoop and clam shell. Conveyance of power to machinery placed below ground. Rotary and percussive rock worked by steam, water, compressed air, or electricity. Air compressors, hand drills; theory of blasting; method of putting in holes; explosives used in blasting; powder; nitro-glycerine; other high explosives; fulminates; directions for using and methods of firing; charging detonators; methods of firing blasts; ventilation; removal of stuff; substitutes for explosives; breaking ground by the action of water or fire; attack of ground; driving of drifts and tunnels; sinking and raising; sinking of shafts and slopes.

Supports. Timber; kinds of timber used for supporting excavations; dry rot; processes used for the preservation of timber; modes of timbering levels, shafts, winzes, slopes and other excavations; masonry and iron or steel supports for similar purposes; special methods of support in the case of watery and running strata; compressed air, freezing and other processes; saving of timber resulting from the adoption of caving and filling methods.

Exploitation, or working away minerals. Open works. Hydraulic mining. Working of deposits and support of excavations; methods applicable to deposits of different thickness, inclination and character. Coal mining, vein mining, working of thick deposits and soft-ore bodies. Salt mining.

Transport, or conveyance along roads. Wheelbarrows, underground tram-cars, use of ponies or horses, mechanical haulage, locomotives for use under ground, electric railways, conveyance of minerals above ground, wire rope-ways.

Winding, or hoisting in shafts or along inclines. Machinery and apparatus required. Buckets, boxes, kibbles, and cages; ropes of various descriptions; pit-head frames; guides or conductors; landing or banking; safety devices and signalling; arrangements for loading and unloading cars and vessels, and for storing minerals.

Drainage. Preventing access of surface water; adits or drainage tunnels; siphons; removal of water by winding machinery; pumping plant; dams.

Ventilation. Composition of air; gases met with underground; causes of the deterioration of air; dangers of dust; natural ventilation, its advantages; ventilation by furnaces; mechanical ventilators of various kinds; distribution of air through the workings; methods of testing the purity of the air; fire-damp detectors; methods of measuring and recording the volume of the air passing through the workings.

Lighting. Candles; lamps fed by tallow, and by animal, vegetable or mineral oils; safety lamps; gas and electric lamps; expense of lighting.

Descent and Ascent. Steps and slides; ladders; winding machinery; safety appliances; man engine.

Principles of Employment. Day wages; contract work by weight or measure; contracts in which men have an interest in the value of the minerals extracted; administration, organization and business management; mine accounts.

Legislation. Special acts relating to mineral laws and the working of mines.

Accidents. Classification; explanation of the commonest kind of accidents; comparison of fatalities at different kinds of mines; comparison of the miner's calling with certain other trades as regards liability to accidents.

Examination and Valuation of Mines.

Miscellaneous Considerations, such as the condition of workmen, surface plants, useful minerals in different parts of the globe, mining statistics, etc.

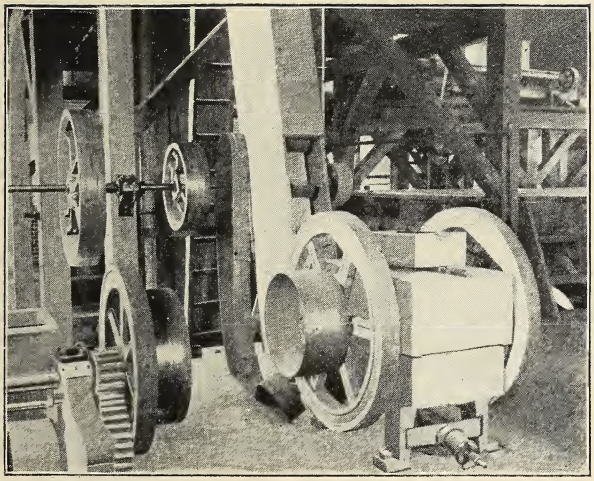
Ore Dressing. The lectures on this subject include the general principles and theory of ore dressing and the mechanical preparation of coal. Washing, packing, crushing and sizing; concentration by various methods; description of typical dressing works and coal washing plants; magnetic separators; manufacture of patent fuel.

Milling. The milling of gold and silver ores will receive especial attention in connection with practical work in the mining laboratory. Physical and chemical properties of gold and of mercury, amalgam, rock-breakers, grizzlies, mortar box and its accessories, screens, dies, the stamp, tappet, stem, head, shoe, cam shaft, cams, cam curve, power, frame, guides, water supply, bins, general arrangement, ore feeders. Arrastra, Huntington Mill. Amalgamation, inside plates, copper tables, mercury wells, amalgam traps, loss of mercury; riffles, blankets, buddles, vanners, sizing, spitzkasten. Treatment of concentrates, amalgamation, chlorination, smelting, cyanidation: cleaning up, treatment of amalgam, cleaning, retorting and melting. Modes of treatment, cost of milling, general considerations. Sampling and assaying of ore, tailings, concentrates and bullion. Washoe process for silver ores; the dry process for rebellious silver ores.

At the conclusion of the course there is an excursion lasting several days to some mining district.

The student who wishes to pass in mining should spend the summer vacations of his second and third years in actual practical work underground, so as to have a general knowledge of the subject before attending the lectures. At the commencement of the mining course, each student should furnish a statement showing what practical work he has done at mines. This statement should be signed by the managers of the mines at which he has worked.

In the final examination in mining, regard will be had to the proficiency of the student in assaying and in surveying; no student can pass in mining unless he has qualified in these two subjects.



Rolls. Crusher. Frue Vanner.

MINING LABORATORY.

MINE SURVEYING.

Practical instruction is carried on in mine surveying, including the following subjects:

i. The measurement of distances.
ii. The miner's dial, and its application to surveying, both at the surface and underground.
iii. The variation of the magnetic needle.
iv. Surveying with the magnetic needle in the presence of iron.
v. Surveying with the fixed needle.
vi. The German dial.
vii. The theodolite.
viii. Traversing underground.
ix. Surface surveys with the theodolite.
x. Plotting surveys.
xi. Calculation of acres.
xii. Levelling.
xiii. Connection of the underground and surface surveys.

Special attention is given to field work.

Text-books—C. Le Neve Foster's "Ore and Stone Mining." (Chas. Griffin & Co., (Ltd.), Exeter St., Strand, London.)
H. W. Hughes' "Coal Mining." (Chas. Griffin & Co., (Ltd.), Exeter St., Strand, London.)

Books for reference:
John Milne's "Miner's Hand-Book." (Crosby, Lockwood & Son, London.)
M. C. Ihlseng's "Manual of Mining." (John Wiley & Son, 53 Tenth St., New York.)
H. Louis' "Hand-book of Gold Milling." (Macmillan & Co., London and New York.)
Arnold Lupton's "Mining." (Longmans, Green & Co., London.)
J. H. Merivale's "Notes and Formula for Mining Students." (Crosby, Lockwood & Son, London.)

THE MINING LABORATORY AND ORE TESTING WORKS.

The School is now provided with a *mining laboratory* and experimental reduction works, which is furnished with a stamp mill, a concentrator, a sample grinder, rolls and other machines with which ores are treated at the mines; also a reverberatory roasting furnace, a chlorination plant and a cyanide plant. In selecting these machines, local and provincial as well as general conditions have been kept in view. The machines are of sufficient size to operate upon large quantities of ore (a ton or two can be easily handled). To test the suitability of processes, by getting such tests made, costly mistakes may be avoided. The value of the mill in this respect has already been shown in several instances.

The mining laboratory is a distinctive feature of well-equipped mining schools. The various operations of crushing, stamping, grinding, amalgamating, concentrating, chlorinating, sampling, and assaying are, by its aid, studied in such a way as to give the student a lively appreciation of the difficulties to be overcome and the care necessary in these operations.

Through the kindness of the Ingersoll Drill Co., Montreal, there has been added to the collection of machinery for demonstration an Ingersoll Rock Drill, complete, which can be attached by hose to the laboratory steam and shown in operation.

The Northey Manufacturing Co., Toronto, has presented the School with a mining pump, with all attachments complete. For further description of this machine see p. 39.

The plant of the mining laboratory will be added to as circumstances render additions advisable.

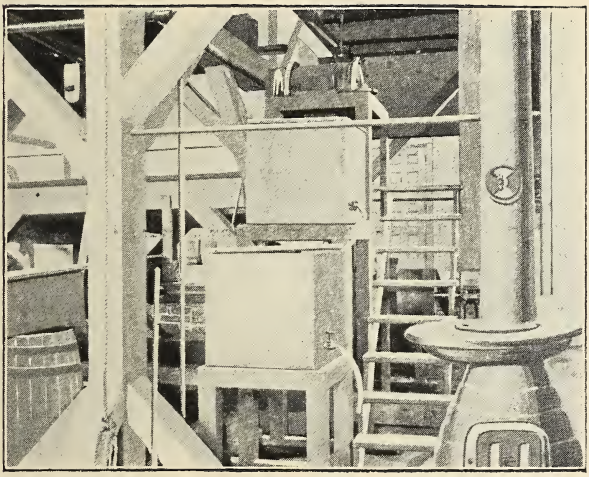
MECHANISM.

Lecturer: N. F. Dupuis, M.A., F.R.S.C.

Workshop Instructors: F. W. Jackson and .....

The instruction in mechanism is both theoretical and practical, and is given by means of lectures and the study of the actions of models, and by construction of machines, or their parts, in the mechanical workshop.

The lectures include the subjects of wheels, screws, belts, etc. The resolution of motion, cranks, and eccentrics, levers, link-work, and joint movements. Conversion of reciprocating into rotatory motion and conversely. The teeth of wheels, trains of wheels and computations; aggregate movement and miscellaneous contrivances.



CHLORINATION BARREL AND TANKS.

Special machines are considered in some detail; such as the clock, the steam engine, the steam pump, the lathe, the dynamo, and the motor, and various other and less important ones.

The teaching in the mechanical workshop consists of instruction in wood-working and in metal working, in turning and in general workshop operations. Students will be required to make patterns in wood; and also to make models and parts of models in both wood and metal; and in each session the more advanced students will be set to work to construct in detail some prominent or important machine.

CIVIL ENGINEERING.

Professor: R. Carr Harris, C.E.

THIRD AND FOURTH YEARS.

The sections marked (3) will form the principal subjects for the third year, and those marked (4) for the fourth; but in neither year will the work of the class be confined to the subjects thus indicated.

(3) Construction of coffer dams and caissons and sinking foundations under water.

(3) Nature, production, and use of materials of construction, building stones, limes, cements, mortars, woodworks.

(3) Cross-sectioning for contours and cross-sectioning for quantities.

(3) Estimating quantities of excavation and embankments and structures; common roads.

(3) Location and drainage and construction.

(3) Tramways; curvature and gradients and trestle works.

(3) Profile sections and plans.

(4) Elementary machines and moduli.

(4) Work of an expanding gas or steam.

(4) Hydraulic principles and hydraulic structures.

(4) Hydraulic machines and motors.

(4) Construction of reservoirs, flumes and aqueducts.

(4) Masonwork specifications and construction of stoneworks and of brickworks.

(4) Principles of designing structures.

(4) Strength of materials.

(4) Stresses on framed structures, bridges, and roofs.

Books for reference:

Dictionary of Engineering: Spon.
Civil Engineering: Rankine.
Treatise on Foundations: Paton.
Highway Construction: Bryne.

DRAWING.

Lecturer: Wm. Mason.

In each year attendance of at least eight hours a week is required.

At the beginning of each session all students are required to have in possession sets of drawing instruments and materials of approved standard. Students must supply their own drawing paper, which must be of an approved quality.

The lectures and practical work in the second year are arranged with a view to the contemplated pursuits of students in the several branches of engineering. Working sketches of portions of machinery, with details, dimensions, etc., will be frequently assigned as exercises outside of class hours. Studies other than those from the lectures and text-books are not allowed in the drafting-room, unless by special permission.

First Year.

Drawing methods, instruments and materials; linear drawing, with the application of practical geometry; blackboard practice in freehand geometrical figures; projection of solids; elementary perspective; isometric drawing; tinting and lettering; tracing; blue printing.

Books for reference—Davidson's Linear Drawing and Projection; Davidson's Practical Perspective; Davidson's Drawing for Machinists; MacCord's Mechanical Drawing.

Second Year.

Freehand drawing; practical perspective; elementary and advanced machine construction; mechanical drawing of mining, electrical and other machinery; designing; elementary architecture; ornament; freehand sketching of machinery.

Books for reference.—Warren's Perspective; Cryer and Jordan's Machine Construction and Mechanical Drawing; Thorne's Mechanical Drawing; Smith and Slater's Classic and Early Christian Architecture; MacCord's Mechanical Drawing.

SURVEYING.

Lecturer: Wm. Mason.

The grounds of Queen's University and vicinity afford favourable features for topographical instruction. The earlier weeks of the session are chiefly occupied with outdoor work, the field notes thus collected being then plotted. The important subject of mine surveying receives full consideration.

First and Second Years.

Methods of plane, topographical and railway surveying; elementary field work; use and adjustment of surveying instruments; maps and scales; calculations; methods of plotting; topographical drawing; lettering; advanced field work; triangulation; contouring; mine surveying.

Books for reference.—Gillespie's Land Surveying; Trautwine's Engineer's Pocket-Book; Reed's Topographical Drawing and Sketching; Brough's Mine Surveying.

Third Year.

Plans, profiles, and cross sections; mine surveying; estimates of quantities. (For details of Mine Surveying see under *Mining Engineering*.

Books for reference.—As for first and second year.

The Classes in English, Mathematics, Physics and Animal Biology are taken in Queen's University.

ENGLISH LANGUAGE AND LITERATURE.

Professor: James Cappon, M.A.

Tutor: R. Burton.

Junior Class.

1. Practical course in Rhetoric and Composition.
2. Lectures on style in connection with the study of passages from Bacon, Jeremy Taylor, Sir Thomas Browne, Addison, Johnson, Burke, Macaulay.
3. A detailed study (in class of the following works:
   Chaucer, Prologue to Canterbury Tales.
   Shakespeare, Merchant of Venice.
   Carlyle, Essay on Burns.
   Lowell, Emerson The Lecturer.
   Tennyson, Morte d'Arthur.

MATHEMATICS.

Professor: N. F. Dupuis, M.A., F.R.S.C.

Assistant: N. R. Carmichael, M.A.

First Year.

The theory and practice of *Algebra* to the Binomial theorem inclusive. Dupuis' Algebra—the first thirteen chapters, omitting chapters XI and XII.

Geometry of the point, line, and circle in the plane. Parts I and II of Dupuis' Plane Geometry.

Besides numerous class-exercises, weekly written exercises will be required.

Mondays, Wednesdays and Fridays at 3 p.m.

SECOND YEAR.

Algebra—Dupuis' Algebra, from the twelfth chapter to the end.

Geometry—Part III of Dupuis' Plane Geometry, and the first 131 pages of Dupuis' Solid Geometry.

Trigonometry—Preceding De Moivre's theorem.

Besides numerous class-exercises periodical written exercises will be required.

THIRD YEAR.

Elementary Co-ordinate Geometry.

Thursdays at 3 p.m.

Elementary Differential and Integral Calculus.

Thursdays at 11 a.m.

Spherical Trigonometry and Astronomy.

Wednesdays at 4 p.m.

PHYSICS.

Professor: D. H. Marshall, M.A., F.R.S.E.
Demonstrator: W. C. Baker, M.A.

JUNIOR AND SENIOR CLASSES.

Lectures and Experiments are given in the following subjects:

Properties of Matter.

Extension—Inertia—Mass—Density—Gravitation—Specific weight—Weight of gases—Molecular forces—Energy.

Dynamics.

Kinematics—Statics of solids and fluids—Kinetics of solids and fluids.

Heat.

Thermometry—Calorimetry (Specific and Latent Heats)—Hygrometry—Transference of Heat (Conduction and Radiation)—Dynamical theory of heat.

Light.

General Laws of Radiant Energy—Geometrical Optics—Physical Optics—Construction and use of Optical Instruments—Spectrum analysis.

Acoustics.

Propagation of Waves—Physical Theory of Music.

Magnetism.

With special reference to terrestrial magnetism.

Electricity.

Frictional Electricity—Voltaic Electricity — Electro-Magnetism — Dia-Magnetism — Magneto-Electricity — Thermo-Electricity — Electro-Dynamics.

Algebra, Geometry, and Trigonometry are applied to the solution of the problems, and weekly exercises are given throughout the session.

In the Junior Class the following subjects are principally studied: Properties of matter, dynamics, heat, magnetism, and fractional electricity. In the Senior: dynamics, voltaic electricity, electro-magnetism, magneto-electricity, thermo-electricity, light and sound.

Text-book—Marshall's *Introduction to the Science of Dynamics*, parts I and II (to be obtained from the Registrar, price $1.00 for each part).

The following books should be consulted in connection with the lectures:

Deschanel's Natural Philosophy or Ganot's Physics.
Gage's Elements of Physics.
Clerk Maxwell's Matter and Motion.
Tait's Properties of Matter.
Balfour Stewart's Heat.
Taylor's Sound and Music.
Silvanus Thompson's Electricity and Magnetism.
Chambers' Mathematical Tables.

Students who have not studied the Ontario High School Physics are recommended to do so, as questions from this work will be given at the monthly examinations.

Students in the Junior and Senior Classes are offered the privilege of experimenting in the Physical Laboratory under regulations to be explained at the beginning of each session.

The classes of Junior and Senior Mathematics should be taken if possible before the Physics classes.

ANIMAL BIOLOGY.

Professor: A. P. Knight, M.A., M.D.
Tutors: W. Moffatt, M.A., A. R. Williamson, M.A.

Students in medicine are required to take the Pass class.

Students in arts who intend subsequently to study medicine are advised to take the pass and honour classes, and thus complete their physiology and histology during their undergraduate course.

Pass Class.

The course in this subject begins on the 1st of October and lasts until the end of January. Lectures or demonstrations will be given daily, 10 to 11 a.m. For laboratory work, the class will be divided into two sections, one of which will be taken on Wednesdays and Thursdays at 10 and 11 a.m. respectively, and the other on Fridays, 10 to 12 m.

The lectures treat of protoplasm, cells, cell division, reproduction, early stages of development, tissues, organs, differences between animals and plants, general view of invertebrata and of vertebrata.

The laboratory work consists of such dissections and demonstrations as will elucidate the subject of the lectures. The lectures are illustrated by diagrams, charts, and lantern transparencies.

The senior leaving examination in Biology of the Education Department is accepted in lieu of attendance and examination in this class.

Text-books—Campbell's Introduction to the Study of Elementary Biology. (Macmillan & Co.)
Foster & Shore's Elementary Physiology. (Macmillan & Co.)

PROSPECTORS' COURSE.

The School offers to mine foremen, assayers, prospectors, and mining men generally, special courses of instruction, beginning January 4th, 1898, and continuing for eight weeks, as follows:

1. CHEMISTRY.—A short course of lectures illustrated by experiments, introductory to the courses in mineralogy and assaying.—DR. GOODWIN.

2. MINERALOGY.—Lectures illustrated by specimens, dealing with the general principles of mineralogy, and accompanied by practice in identifying minerals by field tests.—PROF. NICOL.

3. GEOLOGY.—Lectures on the elements of geology, with illustrations from the geology of Ontario. *Ore Deposits* will claim special attention.—PROF. MILLER.

4. LITHOLOGY.—The character and modes of occurrence of rocks generally—Examination of hand specimens—Special attention will be given to the crystalline rocks of Ontario, the more typical mineral-bearing rocks being well represented by specimens in the collection.—PROF. MILLER.

5. DISCOVERY AND WINNING OF ORES.—This course will be of particular interest to mining men and prospectors, as it will deal with the application of the principles of chemistry, mechanics, mineralogy and geology to the discovery and winning of valuable minerals, and to the usual methods and machinery in vogue to open up the deposits and exploit and prepare the ore.

6. MILLING.—The class will have opportunities of learning in the *mining laboratory* the use of crushers, stamp mill, roasting furnace, chlorination apparatus, and other machinery.

7. BLOWPIPING.—A practical course intended to give facility in the use of the blowpipe for the identification of minerals.—PROF. NICOL.

8. ASSAYING.—Opportunities will be given for practice in field methods, particularly in the pan amalgamation assay.—PROF. NICOL.

9. Drawing.—The elements of mechanical and free-hand drawing as applied to surveys of mining claims and mines, to mining plant, &c.—Mr. Mason.

10. Advanced Work.—Those who are prepared for such work may attend (without charge) lectures on *technical chemistry*, and on *advanced mineralogy and geology*.

Fees.—Every student must pay a registration fee of one dollar. For all the elementary courses (No. 1 to 8 inclusive) a fee of ten dollars will be charged; for any one of them two dollars. Fees for the use of the laboratories for advanced work will be in proportion to the number of hours a week; but not to exceed eight dollars.

Other Expenses.—Good board can be had in the city at from $3.00 to $4.00 a week. The other items of expense (for books, &c.,) need not be large.

The work is made thoroughly practical; and those who wish to enter upon it can do so with advantage, even though they may have had no previous scientific education.

EXTRAMURAL CLASSES FOR PROSPECTORS AND MINING MEN.

The School of Mining sends lecturers to mining centres to conduct classes in Elementary Chemistry, Mineralogy, and Geology as applied to the discovery and testing of economic minerals. Sets of apparatus and chemicals are provided, and those attending these classes have an opportunity of learning to use the blowpipe for the detection of minerals, and to make silver and gold assays with the blowpipe and by pan amalgamation.

SUMMER SCHOOL OF SCIENCE.

This school is conducted by members of the staff of the University and of the School of Mining and Agriculture. Its object is to assist teachers and others who cannot attend the University during the winter session in completing a University course in arts. Two or three subjects are to be taken up each session, their nature depending on the applications that may be made by candidates. For the session of 1897, the subjects will be Chemistry, Mineralogy, and Geology.

Classes will begin July 5th, 1897, and continue in session for about four weeks.

FIELD CLASSES IN GEOLOGY AND PROSPECTING.

The attention of students and others is called to the annual tour of three weeks for the practical study of geology, mineralogy and prospecting methods. Some of the chief mineral localities of the Kingston district are visited each session, and abundant opportunities are offered for collecting specimens and studying the modes of occurrence of substances of economic value. All students in geology and mineralogy are expected to take advantage of these excursions.

THE BRUCE CARRUTHERS SCHOLARSHIP.

The following are the conditions upon which this scholarship is to be awarded and held:

1. The candidate must have sufficient practical knowledge to run the milling machinery in the mining laboratory, viz.:—Crusher, rolls, stamp mill, frue vanner, and sample grinder. It is particularly required that he be acquainted with amalgamating.

2. The candidate must have entered upon, or be prepared to enter upon one of the courses of study as at page 12.

3. The scholar must run the machinery in the mining laboratory when required, must take care of the machinery and see that it is kept in good repair. It is understood that these duties are to be so arranged as to interfere as little as possible with the studies of the scholar.

4. The scholarship may be held for more than one session.

5. Applications will be received up to April 1st.

MINERAL AND GEOLOGICAL SPECIMENS.

It is desired to make the collections of this School as complete and representative as possible of the mineral resources of Canada. Specimens sent to the School will be named free of charge. Good specimens presented to the School will be labelled with the name of the donor and the locality, and will be preserved for reference.

Samples under 25 lbs. in weight may be sent by express; over that weight, by freight.

Specimens should be addressed to the Professor of Mineralogy, or to the Professor of Geology, School of Mining, Kingston, Ont.

DONATIONS OF MINERALS AND MACHINERY.

1. Amethyst. From Mrs. J. W. De Wolfe, Spencer's Island, N.S.
2. Amethyst. From G. W. Newcombe, Canning, N.S.
3. Specular Ore. From Dr. E. W. Fillimore, Spencer's Island, N.S.
4. Crystallized Azurite. From Copper Queen Mine, Arizona.

5. Limonite, &c. From Otto Hertig, Acadia Mines, Londonderry, N.S.

6. Jasper and Quartzite. From T. J. Kelly, Glendower, Bedford, Ont.

7. Amethyst, Apatite, Celestite, Feldspar, Perthite, and White Quartz. From Josiah Legg, Gananoque, Ont.

8. Corundum. From Geological Survey of Canada.

9. Anthraxolite. From Mrs. T. J. Ryan, Sudbury, Ont.

10. Barite. From T. J. Rudd, Kingston, Ont.

11. Anthraxolite from Fairbank, near Larchwood, Ont. From Bryce J. Saunders, C.E.

12. Anthraxolite from Sudbury District. From Major Ainsley Megraw, Wiarton, Ont.

13. Asbestos. From Danville Asbestos & Slate Co. (per Dr. G. M. Dawson, C.M.G.)

15. Crude and refined Graphite. From Ontario Graphite Co., Ltd., Ottawa.

16. Gold Quartz from Craig Mine, Tudor Tp., Hastings Co, From J. W. Curry, B.A., Toronto.

17. Mica and Apatite. From G. E. Jackson, Gananoque, Ont.

18. Native Copper on Quartz. From John Dack, Ardoch, Ont.

19. Box of Copper and Iron Pyrites. From John Blue, C. and M.E., Eustis Mining Co., Capelton, Que.

20. Mining Pump, 3x2x3, Duplex, complete, with lubrication wrenches, jet and drain cocks, &c. From Northey Mfg. Co., Toronto. This fine piece of mining machinery is a valuable addition to the collection for demonstrating mining operations. It is small enough to be used as a working model, and at the same time large enough to illustrate the actual use of such machines in mining.

DONATIONS OF BOOKS, &c.

1. Geological Survey of Canada Annual Report, Vol. VII., 1894; Reports (A, B, C, F, I, M, R, S) 1894; Maps Nos. 556, 557, 561, 562, 563, 567, 571; Summary Report, 1895; Summary of the Mineral Production of Canada for 1895; Annual Report, Vol. VIII.; Section of Mineral Statistics and Mines Annual Report for 1895. From Geological Survey Department of Canada.

2. Geological Atlas of the United States, Folio 7, and Folios 13 to 25; Annual Report, 1893-94; Annual Report, 1894-95 (parts 1, 2, 3 and 4); Bulletins 123 to 126, 128, 129, 131 to 134. From the United States Geological Survey Department, Washington, D.C.

3. Experiment Station Record, Vol. VII., Nos. 6 and 7; Chart, the Lessons of Erasion due to Forest Destruction. From the United States Department of Agriculture, Washington, D.C.

4. Annual Report of the State Geologist for 1895. From Geological Survey Department of New Jersey.

5. Proceedings of Society, Vol. 27, pp. 1 to 199, 243 to 330; Vol. 28, pp. 1 to 44. From the Boston Society of Natural History, Boston, Mass.

6. University Circulars, Vol. XV., Nos. 125 and 126, Vol. XVI., No. 129; Hospital Bulletin, Vol. VII., No. 61. From Johns Hopkins University, Baltimore, Md.

7. Volume III. Brochure I., 1896. From Academy of Science, Rochester, N.Y.

8. Transactions, Vol. IV., part 2, Dec. 1895. From Canadian Institute.

9. Journal, Vol. I., parts 1 to 20. From Canadian Mining Institute, Ottawa.

10. Annual Report for 1894, with maps (2 copies). From Bureau of Mines, Toronto, Ont.

11. The Census of Canada, 1870-71, 5 vols.; Gen. Report of the Census of Canada, 1880-81; Census of Canada, 1880-81, 3 vols.; Census of Manitoba, 1885-86; Census of N. W. Terr, 1884-85; Johnson's Graphic Statistics of Canada, 1887. From Statistical Office, Department of Agriculture, Ottawa.

12. Annual Report of Department of Agriculture, 1895, Vols. I. and II.; also Annual Reports as follows:—Bureau of Industries; Agricultural and Experimental Union (2 copies); Entomological Society; Agricultural College and Experimental Farm; Live Stock Association; Farmers' Institute. Road Bulletins Nos. 1 and 2; Bulletins, Agri. Coll., 101-104; Bureau of Indus., 57-60. From Department of Agriculture, Toronto.

13. Annual Report of Mines, 1895. From the Minister of Mines, Victoria, B.C.

14. Annual Reports for 1894 and 1895, Worthies of old Red River. From the Historical and Scientific Society of Manitoba.

15. Report of the Auditor-General for year ending 30th June, 1896. From the Auditor-General, Ottawa.

16. Address, "The Functions of a Great University." From the author, J. M. Clark, M.A., LL.B., Toronto University.

17. Paper No. 9, 1895-6. From School of Practical Science, Toronto.

18. Proceedings and Transactions, Vol. IX., part 2, Nova Scotia Institute of Science, Halifax, N.S.

19. Economic Minerals of the Province of Ontario. From the author, W. Hamilton Merritt, M.E., F.G.S.

20. Land Titles Act, Ont., 1887; Joint Stock Co's. Act, Ont., 1887 (3 copies); The Mines Act, Ont., 1892 (3 copies). From Joseph Bawden, barrister-at-law, Kingston, Ont.

21. Four Photogravures (in oak frames) of Rocky Mountain and British Columbia Scenery. From Canadian Pacific Railway Co.

22. Six Catalogues of Mining Machinery. From the Gates Iron Co., Chicago, Ill.

23. Magazines, &c.: "Canadian Engineer," Toronto; "The News," Rat Portage, Ont.; "Mining News," Montreal, Que.; "The Province," Victoria, B.C.; "The Mining Record," Victoria, B.C.; "Inland Sentinel," Kamloops, B.C.; "Mining," Spokane, Wash.; "Cement and Engineering News," Chicago, Ill.; "Mining and Scientific Press," San Francisco, Cal.

24. Calendars (12) of Universities, Colleges and Mining Schools.

SPECIMENS EXAMINED AND REPORTED ON FREE OF CHARGE.

1. D. Williams, Kaladar. Fibrous actinolite. Readily pulverizes to a cotton-like product suitable for fire-proof paint or for packing; a possibility of its winning into good asbestos.

2. Peter Nicholson, lot 13, Con. 5, Bedford Tp. Pyritiferous quartz. No apparent value.

3. Messrs. Leech Bros., Carleton Place. Information concerning the occurrence of granite in Ontario.

4. Francis Murphy, Elginburg. Three samples: Protogene; decomposed micaceous schist impregnated with iron; decomposed rock matter containing magnetite. No commercial value.

5. Jas. Zariby, Moneymore. Concretionary pyrite with calcite in limestone. Not of economic importance.

6. John Smith, Popcum, B.C. Samples of pyrite and pyrrhotite.

7. J. H. Feeley, Lovering. Pyrite in gabbro. No value.

8. Richard Emmons, Shannonville. Solutions of iron. Decimal results given.

9. T. J. Kelly, Glendower, Bedford. Three samples: Jasper; Sandstone-quartzite; quartz (not found *in situ*). No commercial value.

10. Mr. Wilson, Kingston. Specimens of mica from Nipissing district. Of good quality, clear, variety muscovite, large crystals. Probably of economic importance.

11. S. Donaldson, Donaldson's Mills. Three samples: Magnetite; hæmatite; quartz. Magnetite good; hæmatite good, and, if present in quantity, would be of considerable value; quartz, barren-looking.

12. Josiah Legg, Gananoque. Four samples: Celestite; perthite; amethyst; apatite. The celestite, if in large enough vein, might be used by sugar refiners.

13. John P. Goodfield, Howe Island. Pyrite and quartz in rock matter.

14. Lawrence Meany, Eganville. Sample containing quartz, hornblende, and feldspar as rock-forming minerals, with pyrite, magnetite and pyrrhotite as accessories. No value.

15. E. M. Huffman, Portland. Three samples of hæmatite. Very good.

16. Wm. Fairbairn, Calabogie. Ten samples: Pyrite and pyrrhotite; quartz (2); graphite; magnetite; gneiss (4). All favourable specimens.

17. Carswell and MacKay, Calabogie. Three samples: Arsenopyrite and pyrite in crystalline limestone; molybdenite; chalcopyrite with quartz. Favourable, if in sufficient quantities.

18. E. T. Lumb, Fort Stuart. Rusty quartz. If in quantity, worth assaying for gold.

19. P. Kingston, Bedford. Four samples: Pyrite in quartz and rock matter (2); musty cavernous quartz (2). If in quantity worth assaying for gold.

20. Mr. Wilson, Desert Lake. Three samples: Serpentine; talc (impure); decomposed dyke rock.

21. R. G. Strong, Brooke. Pyrite in quartz. If in well-defined vein, might carry gold.

22. W. D. Black, Parham. Quartz with decomposed pegmatite. If vein is well defined, should be assayed.

23. A Joyce, Calabogie. Specimens of copper pyrites in decomposed granite. Unfavourable.

24. Robert Flynn, Mountain Grove. Quartz. Not promising.

25. C. H. Spencer, Roblin. Quartz; worth assaying. Galena in calcite; and galena and zinc blende in quartz; may carry silver.

26. Robt. P. Byrnes, Tamworth. Specimens of actinolite in quartz, calcite, etc. No commercial value.

27. T. Deir, Warburton. Quartz, pyrite and mica in weathered gneiss.

28. Joseph George, Kingston. Rusty cellular quartz, with some undecomposed pyrite. If plentiful, worth an assay.

29. Robert Phillips, Rimington. Quartz, colored with hæmatite. No value.

30. H. F. McQuire, Webbwood. Pyrite and quartz in coarse diorite. No value.

31. Dr. Gardiner, Seeley's Bay. Granular pyrite in Potsdam sandstone.

32. Arza Sherman, Athens. Quartz, with crystals of pyrite. Not promising.

33. E. H. Snook, Desert Lake. Pyrite in decomposed granite rock matter.

34. Messrs. Folger Bros., Kingston. Specimens of auriferous quartz from Sawbill. Rich in gold.

35. John Dawson, Sault Ste. Marie. Samples of rock containing jasper, etc. No value.

I. STUDENTS WHO HAVE PASSED EXAMINATIONS.

Junior English—J. P. Anglin, F. W. Jackson, W. F. Smeeton, H. Smallwood.

Junior Mathematics—J. P. Anglin, W. F. Smeeton, F. W. Jackson.

Algebra I.—C. L. Fortescue, H. S. Baker.

Modern Geometry—C. L. Fortescue.

Calculus I.—H. S. Baker.

Elementary Trigonometry—W. F. Smeeton, J. P. Anglin.

Mechanism—G. H. Kirkpatrick.

Workshop—T. S. Scott, B.A., C. L. Fortescue, H. S. Baker, G. H. Kirkpatrick, S. H. Squire, C. P. Merritt, W. Lavell, J. W. Wells, M. P. Cotton, M. G. Spotswood, S. N. Graham.

Junior Physics—J. P. Anglin, W. F. Smeeton, H. Smallwood, C. P. Merritt, M. P. Cotton.

Electricity—T. S. Scott, B.A., C. L. Fortescue.

Descriptive Astronomy—C. L. Fortescue, G. P. Anglin.

Junior Chemistry—F. W. Jackson, W. E. Mann, W. F. Smeeton, C. L. Fortescue, H. Smallwood, C. G. Rothwell, M. P. Cotton.

Senior Chemistry—G. H. Kirkpatrick, S. N. Graham, C. P. Merritt.

Mineralogy (First Year)—W. E. Mann, W. F. Smeeton, C. G. Rothwell.

Mineralogy (Descriptive)—G. H. Kirkpatrick, J. W. Wells, Jno. Donnelly, jr., M. G. Spotswood.

Mineralogy (Determinative)—G. H. Kirkpatrick, C. G. Rothwell.

Assaying and Quantitative Analysis—G. H. Kirkpatrick, J. W. Wells.

Assaying (only)—W. E. Mann.

Blowpiping—O. N. Scott.

Geology (First Year)—W. E. Mann, C. G. Rothwell, C. P. Merritt.

Economic Geology—J. W. Wells, G. H. Kirkpatrick, W. E. Mann.

Petrography—G. H. Kirkpatrick, J. W. Wells.

Mining (Third Year)—G. H. Kirkpatrick, J. W. Wells.

Mining (Fourth Year)—G. H. Kirkpatrick, Jno. Donnelly, jr., M. G. Spotswood.

Junior Civil Engineering—H. Lindsay, W. F. Smeeton, M. G. Spotswood, S. N. Graham, J. W. Wells, H. Smallwood, Jno. Donnelly, jr.

Senior Civil Engineering—T. S. Scott, B.A., H. Lindsay, S. N. Graham, Jno. Donnelly, jr.

Drawing (First Year)—J. P. Anglin, S. H. Squire, W. F. Smeeton, H. Smallwood, J. W. Wells.

Drawing (Second Year)—S. N. Graham, M. P. Cotton, C. P. Merritt.

Surveying (First Year)—J. P. Anglin, W. F. Smeeton, F. W. Jackson, C. P. Merritt, J. W. Wells, W. P. Cotton, Jno. Donnelly, jr., H. Smallwood, S. H. Squire.

Surveying (Second Year)—S. N. Graham.

II. GRADUATES.

G. H. Kirkpatrick, B.Sc. in Mining Engineering; T. S. Scott, B.A., B.Sc. in Civil Engineering.

III. BRUCE CARRUTHERS SCHOLARSHIP FOR 1897-98.

Chas. G. Rothwell, Kingston, Ont.